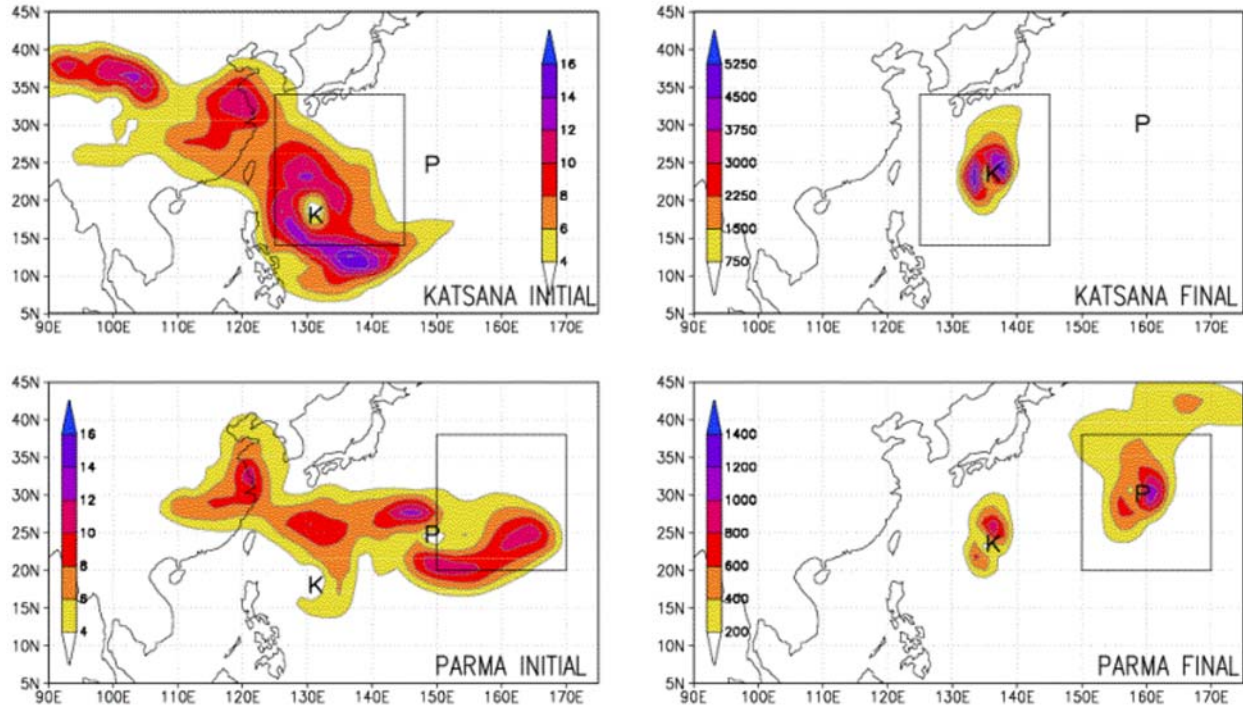


# ADJOINT-BASED PREDICTABILITY TOOLS



**Technology:** The tangent forward and adjoint models of the Navy Operational Global Atmospheric Prediction System (NOGAPS) allow for the calculation of the sensitivity of a particular forecast aspect or forecast error to changes in the initial state. This technology also allows for the calculation of the leading singular vectors (sometimes called optimal perturbations), which represent the fastest-growing perturbations (in a linear sense) to a given forecast. The corresponding adjoint of the NRL Atmospheric Variational Data Assimilation System (NAVDAS) allows for the calculation of the sensitivity of the forecasts to different components of the observing system.

**Advantages:** This technology allows for the calculation of forecast sensitivity and data impact in a mathematically rigorous and computationally feasible manner. It allows one to study the dynamics that influence the development and evolution of particular phenomena. (In the example above, it allows one to examine what particular local and remote features will impact the evolution of tropical cyclones). It also has many practical applications, such as providing guidance as to placement of additional observations for improving forecasts (adaptive observations), and determining the impact of individual components of the observing system in reducing forecast error (observing system design).

## Selling Points:

- ◆ Elucidates important dynamics in complex systems
- ◆ Provides guidance for adaptive observations
- ◆ Provides guidance on observing system design
- ◆ Computationally efficient

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